

VARIANT EMC TEST REPORT

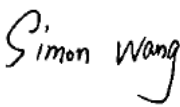
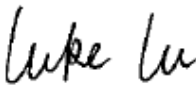
Applicant:	Nokia of America Corp
Address:	3201, Olympus Blvd, Dallas, TX 75019, USA

Manufacturer or Supplier:	Power Idea Technology (Shenzhen) Co., Ltd.
Address:	4th Floor, A Section, Languang Science&technology Building, No.7 Xinxi RD, Hi-Tech Industrial Park North, Nanshan District, ShenZhen, P.R.C.
Product:	Nokia Industrial 5G handheld HHRA501x
Brand Name:	Nokia
Model Name:	HHRA501a
Marketing Name:	Nokia Industrial 5G handheld HHRA501a
FCC ID:	2AVO2-HHRA501A
Date of tests:	Nov. 24, 2022 ~ Feb. 03, 2023

The submitted sample of the above equipment has been tested for according to the requirements of the following standards:

- ☐ FCC Part 15, Subpart B, Class A
- ☒ FCC Part 15, Subpart B, Class B
- ☒ ANSI C63.4:2014

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Simon Wang Engineer / Mobile Department	Approved by Luke Lu Manager / Mobile Department
	
Date: Oct. 23, 2023	Date: Oct. 23, 2023

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
W7L-P22110036EM01	Original release	Feb. 03, 2023
W7L-P23100014EM01	Based on the original product changing the model name and FCC ID, brand name, marketing name, product name, battery model, applicant and manufacturer information.	Oct. 23, 2023

1 GENERAL INFORMATION

1.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Nokia Industrial 5G handheld HHRA501x	
BRAND NAME	Nokia	
MODEL NAME	HHRA501a	
MARKETING NAME	Nokia Industrial 5G handheld HHRA501a	
NOMINAL VOLTAGE	5.0Vdc(adapter or host equipment) 3.7Vdc (Li-ion, battery)	
MODULATION TYPE	BT_LE	GFSK
	Bluetooth	GFSK, $\pi/4$ -DQPSK, 8DPSK
	NFC	ASK
	WLAN	DSSS, OFDM
	GPS/GALILEO/GLO NASS/BDS	BPSK
	GSM/GPRS/EDGE	GMSK, 8PSK
	WCDMA	QPSK
	LTE	QPSK/16QAM/64QAM
	5G NR	DFT-s-OFMA($\pi/2$ BPSK,QPSK,16QAM,64QAM,256QAM); CP-OFMA(QPSK,16QAM,64QAM,256QAM);
OPERATING FREQUENCY	Bluetooth/BT_LE	2402MHz ~ 2480MHz
	NFC	13.56 MHz
	WLAN	2412 ~ 2462MHz for 11b/g/n(HT20/40)/ax(20/40) 5180 ~ 5240MHz, 5260 ~ 5320 MHz, 5500 ~ 5720MHz, 5745 ~ 5825 MHz for 11a/ n(HT20)/ n(HT40) / ac(VHT20)/ ac(VHT40) / ac(VHT80)/ ax(20/40/80)
	GPS/GALILEO/GLO NASS/BDS	1559MHz ~ 1610MHz
	GSM	824.2MHz ~ 848.8MHz (FOR GSM 850) 1850.2MHz ~ 1909.8MHz (FOR GSM 1900)
	WCDMA	1852.4MHz ~ 1907.6MHz(FOR WCDMA Band 2) 1712.4MHz ~ 1752.6MHz(FOR WCDMA Band 4) 826.4MHz ~ 846.6MHz (FOR WCDMA Band 5)

OPERATING FREQUENCY	LTE	1850.7MHz ~ 1909.3MHz (FOR LTE Band2) 1710.7MHz ~ 1754.3MHz (FOR LTE Band4) 824.7MHz ~ 848.3MHz (FOR LTE Band5) 2502.5MHz ~ 2567.5MHz (FOR LTE Band7) 699.7MHz ~ 715.3MHz (FOR LTE Band12) 779.5MHz ~ 784.5MHz (FOR LTE Band13) 790.5MHz ~ 795.5MHz (FOR LTE Band14) 706.5MHz ~ 713.5MHz (FOR LTE Band17) 1850.7MHz ~ 1914.3MHz (FOR LTE Band25) 814.7MHz ~ 848.3MHz (FOR LTE Band26) 2307.5MHz ~ 2312.5MHz (FOR LTE Band30) 2572.5MHz ~ 2617.5MHz (FOR LTE Band38) 2498.5MHz ~ 2687.5MHz (FOR LTE Band41) 3452.5MHz ~ 3597.5MHz (FOR LTE Band42) 3602.5MHz ~ 3697.5MHz (FOR LTE Band43) 3552.5MHz ~ 3697.5MHz (FOR LTE Band48) 1710.7MHz ~ 1779.3MHz (FOR LTE Band66) 665.5MHz ~ 695.5MHz (FOR LTE Band71) 2505.5MHz ~ 2564.7MHz (FOR LTE Band7C) 2577.5MHz ~ 2612.5MHz (FOR LTE Band38C) 2499.3MHz ~ 2686.7MHz (FOR LTE Band41C) 3453.3MHz ~ 3546.7MHz (FOR LTE Band42C) 3553.3MHz ~ 3696.7MHz (FOR LTE Band48C)
	5G NR	SA: n2 (1852.5MHz ~ 1907.5MHz) n5 (826.5MHz ~ 846.5MHz) n7 (2502.5MHz ~ 2567.5MHz) n12 (701.5MHz ~ 713.5MHz) n25 (1852.5MHz ~ 1912.5MHz) n30 (2307.5MHz ~ 2312.5MHz) n38 (2582.52MHz ~ 2607.48MHz) n41 (2506.02 ~ 2679.99MHz) n48 (3555 ~ 3694.98MHz) n66 (1712.5 ~ 1777.5MHz) n71 (665.5 ~ 695.5MHz) n77 (Part27Q) (3460.02 ~ 3540MHz) n77 (Part27O) (3710.01 ~ 3969.99MHz) n78 (Part27Q) (3460.02 ~ 3540MHz)
HW VERSION	V02	
SW VERSION	IS540_ROW_00.00_1_20221017	
I/O PORTS	Refer to user's manual	

CABLE SUPPLIED	USB cable1: non-shielded cable, with w/o ferrite core, 1.0 meter USB cable2: non-shielded cable, with w/o ferrite core, 1.0 meter
ACCESSORY DEVICES	Refer to note as below

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.

List of Accessory:

ACCESSORIES	BRAND	MANUFACTURER	MODEL	SPECIFICATION
Battery	N/A	FPR Connectivity Technology Inc.	BL440ACP	Capacity: 3.7Vdc, 4400mAh
AC Adapter	N/A	SHENZHEN SHI YINGYUAN POWER SUPPLY TECHNOLOGY CO., LTD.	ICP12-050-2000B	I/P: 100-240Vac, 0.3A, O/P: 5.0Vdc, 2A
USB Cable 1	N/A	Winpower Technology Co., LTD	PROTECTOR 2.0	Signal Line,1.0meter
USB Cable 2	N/A	Winpower Technology Co., LTD	USB2.0	Signal Line,1.0meter

1.2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart B		
Standard Section	Test Item	Result
FCC Part 15, Subpart B, Class B ANSI C63.4:2014	Conducted Test	Compliance
	Radiated Emission Test (30MHz ~ 1GHz)	Compliance
	Radiated Emission Test (Above 1GHz)	Compliance

1.3 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	150kHz ~ 30MHz	±2.70dB
Radiated emissions	30MHz~1GHz	±4.98dB
	1GHz ~6GHz	±4.70dB
	6GHz ~18GHz	±4.60dB

1.4 DESCRIPTION OF TEST MODES

Test Mode	Test Condition
Radiated emission test	
1	GSM850 Idle + Adapter + GPS RX + USB cable 1 + Front Camera On + BT Idle + WIFI Idle (2.4G) + SIM
2	WCDMA B5 Idle + Adapter + Glonass RX + USB cable 1 + Back Camera On + BT Idle + WIFI Idle (5G) + SIM
3	LTE B2 Idle + Adapter + BDS RX + USB cable 1 + Front Camera On + BT Idle + WIFI Idle (5G) + SIM
4	LTE B5 Idle + Adapter + Galileo RX + USB cable 1 + Flashlight On + BT Idle + WIFI Idle (2.4G) + SIM
5	LTE B12 Idle + Adapter + USB cable 1 + BT Idle + WIFI Idle (5G) + SIM
6	LTE B13 Idle + Adapter + NFC + USB cable 1 + BT Idle + WIFI Idle (2.4G) + SIM
7	LTE B14 Idle + Adapter + USB cable 1 + BT Idle + WIFI Idle (5G) + SIM
8	LTE B13 Idle + Adapter + USB cable 1 + MPG4 + BT Idle + WIFI Idle (2.4G) + SIM
9	LTE B17 Idle + Adapter + USB cable 1 + Front Camera On + BT Idle + WIFI Idle (2.4G) + SIM
10	LTE B26 Idle + USB Link + Data Transmission + BT Idle + WIFI Idle (2.4G) + EUT to Notebook + USB cable 1 + SIM
11	LTE B71 Idle + USB Link + Data Transmission + BT Idle + WIFI Idle (5G) + Notebook to EUT + USB cable 1 + SIM
12	N5 Idle + USB Link + Data Transmission + BT Idle + WIFI Idle (5G) + SD to Notebook + USB cable 1 + SIM
13	N12 Idle + USB Link + Data Transmission + BT Idle + WIFI Idle (2.4G) + Notebook to SD + USB cable 1 + SIM
14	N71 Idle + Powered by Battery + Handfree + SIM
15	Worst of 1-13 + USB cable 2

Conducted emission test	
1	GSM850 Idle + Adapter + GPS RX + USB cable 1 + Front Camera On + BT Idle + WIFI Idle (2.4G) + SIM
2	WCDMA B5 Idle + Adapter + Glonass RX + USB cable 1 + Back Camera On + BT Idle + WIFI Idle (5G) + SIM
3	LTE B2 Idle + Adapter + BDS RX + USB cable 1 + Front Camera On + BT Idle + WIFI Idle (5G) + SIM
4	LTE B5 Idle + Adapter + Galileo RX + USB cable 1 + Flashlight On + BT Idle + WIFI Idle (2.4G) + SIM
5	LTE B12 Idle + Adapter + USB cable 1 + BT Idle + WIFI Idle (5G) + SIM
6	LTE B13 Idle + Adapter + NFC + USB cable 1 + BT Idle + WIFI Idle (2.4G) + SIM
7	LTE B14 Idle + Adapter + USB cable 1 + BT Idle + WIFI Idle (5G) + SIM
8	LTE B13 Idle + Adapter + USB cable 1 + MPG4 + BT Idle + WIFI Idle (2.4G) + SIM
9	LTE B17 Idle + Adapter + USB cable 1 + Front Camera On + BT Idle + WIFI Idle (2.4G) + SIM

10	LTE B26 Idle + USB Link + Data Transmission + BT Idle + WIFI Idle (2.4G) + EUT to Notebook + USB cable 1 + SIM
11	LTE B71 Idle + USB Link + Data Transmission + BT Idle + WIFI Idle (5G) + Notebook to EUT + USB cable 1 + SIM
12	N5 Idle + USB Link + Data Transmission + BT Idle + WIFI Idle (5G) + SD to Notebook + USB cable 1 + SIM
13	N12 Idle + USB Link + Data Transmission + BT Idle + WIFI Idle (2.4G) + Notebook to SD + USB cable 1 + SIM
14	N71 Idle + Adapter + USB cable 1 + BT Idle + WIFI Idle (2.4G) + SIM
15	Worst of 1-13 (Mode 9) + USB cable 2

NOTE:

1. For conducted emission test, Pre-scan all mode, mode 15 was the worst case and only this mode was presented in this report.
2. For radiated emission test, Pre-scan all mode, test mode 12 was the worst case and only this mode was presented in this report

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

FOR ALL TESTS

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Laptop	Lenovo	Thinkpad L440	R90FTFKP	N/A
2	Micro SD	SAM SUNG	N/A	N/A	N/A
3	GPS Simulator+Antenna	TOJOIN	GNSS-5000A	E1-010-010119	N/A
4	Universal radio communication tester	Rohde&Schwarz	CMW500	N/A	N/A
5	Printer	HP	hp LaserJet 1300	CNSJF75989	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	USB Line: Shielded, Detachable 1m;
2	N/A
3	N/A
4	N/A

2 EMISSION TEST

2.1 CONDUCTED EMISSION MEASUREMENT

2.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

TEST STANDARD: FCC PART 15, SUBPART B (SECTION: 15.107 A CLASS B)

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

TEST STANDARD: FCC PART 15, SUBPART B (SECTION: 15.107 B CLASS A)

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15 ~ 0.5	79	66
0.5 ~ 30	73	60

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

2.1.2 TEST INSTRUMENTS

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESR3	101900	Feb. 15,22	Feb. 14,23
EMC32 test software	Rohde&Schwarz	EMC32	NA	NA	NA
LISN network	Rohde&Schwarz	ENV216	101922	Mar. 04,22	Mar. 03,23

- NOTE:**
1. The test was performed in CE shielded room.

2.1.3 TEST PROCEDURES

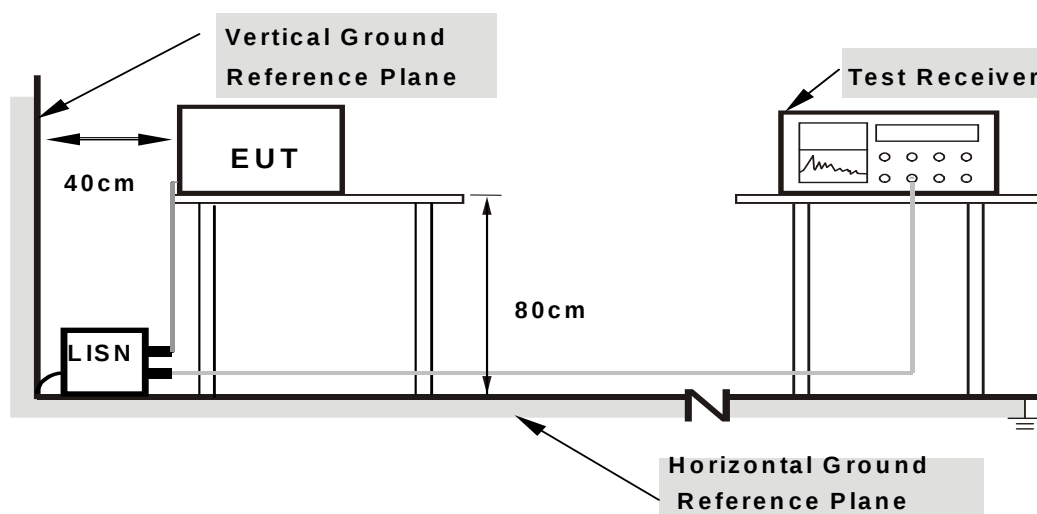
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

2.1.4 DEVIATION FROM TEST STANDARD

No deviation.

2.1.5 TEST SETUP



**Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80
from other units and other metal planes**

For the actual test configuration, please refer to the attached file (Test Setup Photo).

2.1.6 EUT OPERATING CONDITIONS

- a. Turned on the power and connected of all equipment.
- b. EUT was operated according to the use type described in the manufacturer's specifications or the user's manual.

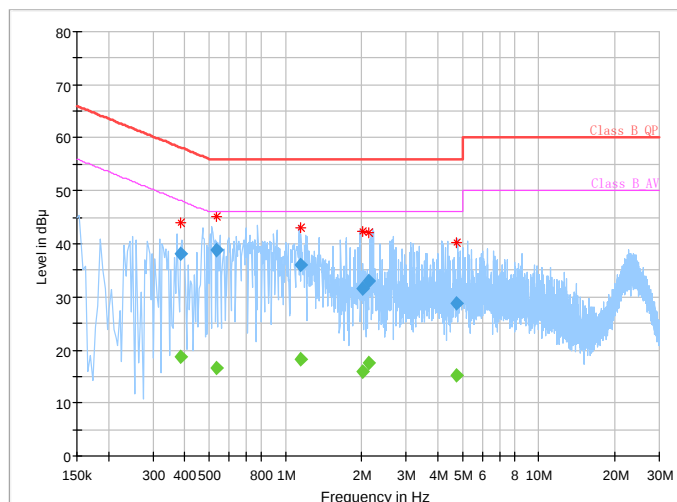
2.1.7 TEST RESULTS

TEST VOLTAGE	Input 120 Vac, 60 Hz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
ENVIRONMENTAL CONDITIONS	26deg. C, 51%RH	TESTED BY	Carl xie

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.384000	---	18.61	48.19	29.58	L1	ON	9.7
0.384000	38.19	---	58.19	20.00	L1	ON	9.7
0.532000	---	16.58	46.00	29.42	L1	ON	9.7
0.532000	38.87	---	56.00	17.13	L1	ON	9.7
1.152000	---	18.27	46.00	27.73	L1	ON	9.7
1.152000	35.91	---	56.00	20.09	L1	ON	9.7
2.020000	---	15.81	46.00	30.19	L1	ON	9.7
2.020000	31.48	---	56.00	24.52	L1	ON	9.7
2.132000	---	17.45	46.00	28.55	L1	ON	9.7
2.132000	32.98	---	56.00	23.02	L1	ON	9.7
4.756000	---	15.27	46.00	30.73	L1	ON	9.7
4.756000	28.67	---	56.00	27.33	L1	ON	9.7

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Limit value - Emission level
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.

Full Spectrum

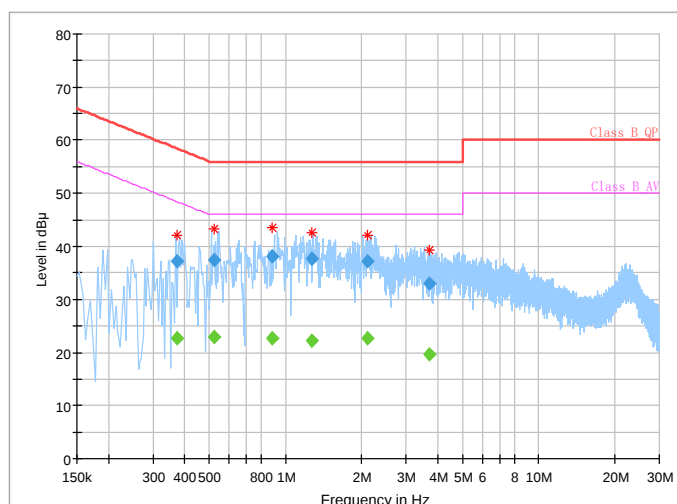


TEST VOLTAGE	Input 120 Vac, 60 Hz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
ENVIRONMENTAL CONDITIONS	26deg. C, 51%RH	TESTED BY	Carl xie

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.372000	---	22.61	48.46	25.85	N	ON	9.7
0.372000	37.18	---	58.46	21.28	N	ON	9.7
0.520000	---	22.92	46.00	23.08	N	ON	9.7
0.520000	37.53	---	56.00	18.47	N	ON	9.7
0.892000	---	22.72	46.00	23.28	N	ON	9.7
0.892000	38.24	---	56.00	17.76	N	ON	9.7
1.268000	---	22.31	46.00	23.69	N	ON	9.8
1.268000	37.73	---	56.00	18.27	N	ON	9.8
2.104000	---	22.77	46.00	23.23	N	ON	9.8
2.104000	37.15	---	56.00	18.85	N	ON	9.8
3.684000	---	19.69	46.00	26.31	N	ON	9.8
3.684000	33.00	---	56.00	23.00	N	ON	9.8

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Limit value - Emission level
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.

Full Spectrum



2.2 RADIATED EMISSION MEASUREMENT

2.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

TEST STANDARD: FCC PART 15, SUBPART B (SECTION: 15.109)

Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 3 meters (dB μ V/m)		
Frequencies (MHz)	FCC 15B, Class A	FCC 15B, Class B
30-88	49	40
88-216	53.5	43.5
216-960	56	46
960-1000	59.5	54
Above 1000	Avg: 59.5 Peak: 79.5	Avg: 54 Peak: 74

Frequency Range (For unintentional radiators)

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5 th harmonic of the highest frequency or 40GHz, whichever is lower

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
 2. Emission level (dB μ V/m) = 20 log Emission level (uV/m).
 3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
 4. QP detector shall be applied if not specified.

2.2.2 TEST INSTRUMENTS

Frequency range below 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	May. 19,20	May. 18,23
Bilog Antenna	ETS-LINDGREN	3143B	00161965	Mar. 06,22	Mar. 05,23
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Feb. 18,22	Feb. 17,23
Signal Pre-Amplifier	EMSI	EMC 9135	980249	May.12,22	May.11,23
E3 Test Software	E3	V 9.160323	N/A	N/A	N/A

Frequency range above 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	May. 19,20	May. 18,23
Horn Antenna	ETS-LINDGREN	3117	00168728	Apr. 02,22	Apr. 01,23
Horn Antenna	ETS-LINDGREN	QWH-SL-18-40-K-SG QMS-00361	15433	Aug. 24, 22	Aug. 23, 23
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Feb. 18,22	Feb. 17,23
Signal Pre-Amplifier	EMSI	EMC 012645B	980257	May.12,22	May.11,23
Signal Pre-Amplifier	EMSI	EMC 184045B	980259	Feb. 21,22	Feb. 20,23
E3 Test Software	E3	V 9.160323	N/A	N/A	N/A

NOTE: 1. The test was performed in 3m chamber.
2. The FCC Site Registration No. is 525120; The Designation No. is CN1171.

2.2.3 TEST PROCEDURE

<Frequency Range below 1GHz>

The basic test procedure was in accordance with ANSI C63.4:2014 (section 12).

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1GHz.

NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. $\text{Emission level(dBuV/m)} = \text{Raw Value(dBuV)} + \text{Correction Factor(dB/m)}$
3. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)}$ (if the raw value not contains the amplifier);
4. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)} - \text{Amplifier Gain(dB)}$ (if the raw value contains the amplifier).
5. $\text{Margin value} = \text{Emission level} - \text{Limit value}$.

<Frequency Range above 1GHz>

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter fully-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. The bore sight should be used during the test above 1GHz.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz

NOTE:

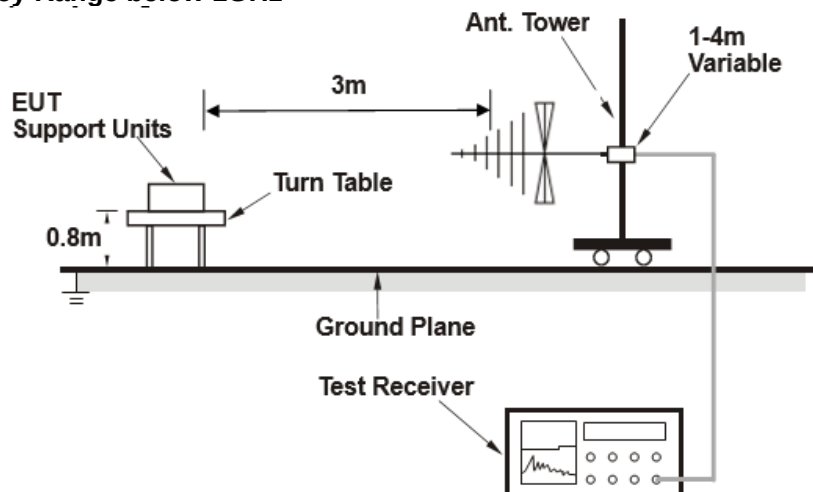
1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth of test receiver/spectrum analyzer is 1Hz for Average detection (AV) at frequency above 1GHz.
3. For measurement of frequency above 1000 MHz, the EUT was set 3 meters away from the receiver antenna.
4. $\text{Emission level(dBuV/m)} = \text{Raw Value(dBuV)} + \text{Correction Factor(dB/m)}$
5. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)}$ (if the raw value not contains the amplifier);
6. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)} - \text{Amplifier Gain(dB)}$ (if the raw value contains the amplifier)
7. $\text{Margin value} = \text{Emission level} - \text{Limit value}$.

2.2.4 DEVIATION FROM TEST STANDARD

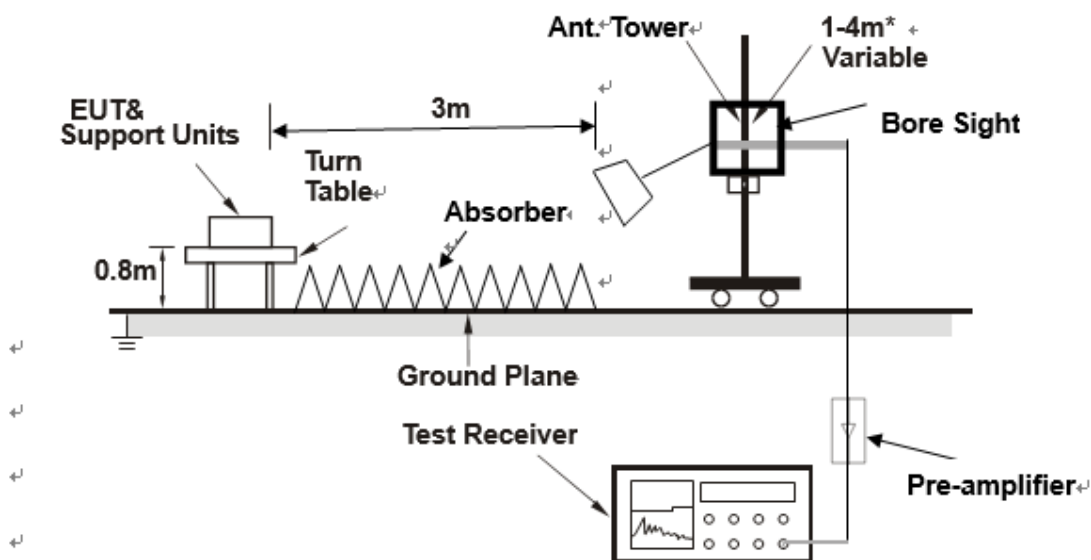
No deviation.

2.2.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



Note: Above 1G is a directional antenna

depends on the EUT height and the antenna 3dB bandwidth both, refer to section 7.3 of CISPR 16-2-3.

2.2.6 EUT OPERATING CONDITIONS

Same as item 2.1.6.

2.2.7 TEST RESULTS

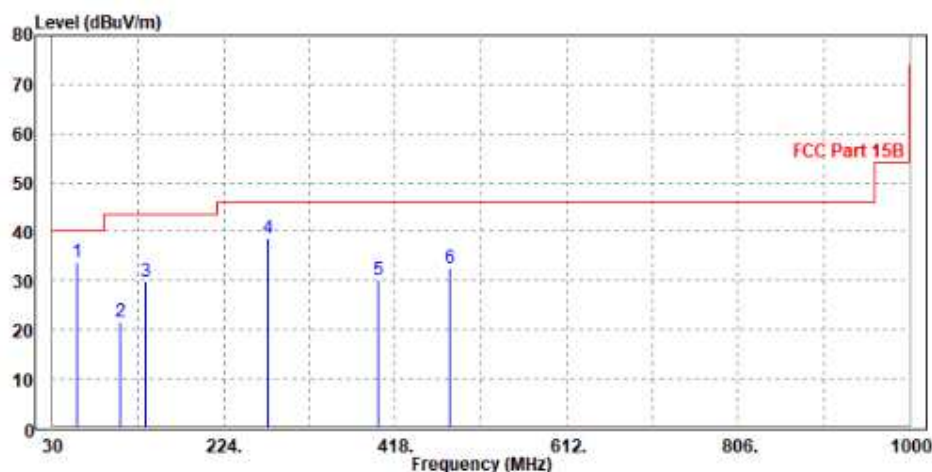
Accelerometer alternative worst case:

TEST VOLTAGE	Data Transmission Input 120 Vac, 60 Hz	FREQUENCY RANGE	30-1000 MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70 %RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Quasi-Peak, 120 kHz
TESTED BY	Jace Hu		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1 PP	57.160	33.80	60.85	40.00	-6.20	-27.05	QP	Horizontal
2	106.630	21.67	47.77	43.50	-21.83	-26.10	QP	Horizontal
3	134.760	29.94	57.12	43.50	-13.56	-27.18	QP	Horizontal
4	274.440	38.76	60.42	46.00	-7.24	-21.66	QP	Horizontal
5	398.600	30.03	49.21	46.00	-15.97	-19.18	QP	Horizontal
6	480.080	32.62	50.29	46.00	-13.38	-17.67	QP	Horizontal

- REMARKS:**
1. Emission level(dBuV/m)=Read Value(dBuV) + Correction Factor(dB/m)
 2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)- Amplifier Gain
 3. The other emission levels were very low against the limit.
 4. Margin value = Emission level – Limit value.

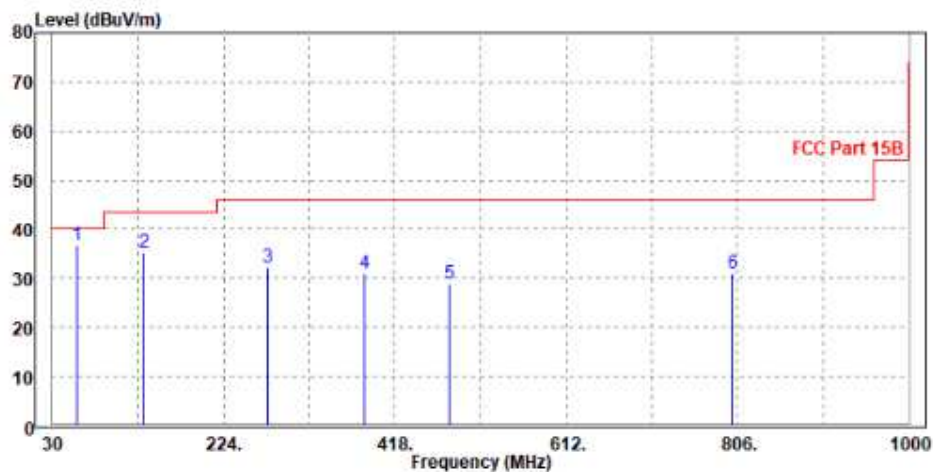


TEST VOLTAGE	Data Transmission Input 120 Vac, 60 Hz	FREQUENCY RANGE	30-1000 MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70% RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Quasi-Peak , 120 kHz
TESTED BY	Jace Hu		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

	Freq	Level	Read Level	Limit Line	Over Limit	Factor	Remark	Pol/Phase
	MHz	dBuV/m	dBuV	dBuV/m	dB	dB/m		
1 PP	57.160	36.82	64.44	40.00	-3.18	-27.62	QP	Vertical
2	133.790	35.29	62.85	43.50	-8.21	-27.56	QP	Vertical
3	274.440	32.34	54.46	46.00	-13.66	-22.12	QP	Vertical
4	384.050	31.17	50.58	46.00	-14.83	-19.41	QP	Vertical
5	480.080	28.84	46.89	46.00	-17.16	-18.05	QP	Vertical
6	800.180	31.16	45.18	46.00	-14.84	-14.02	QP	Vertical

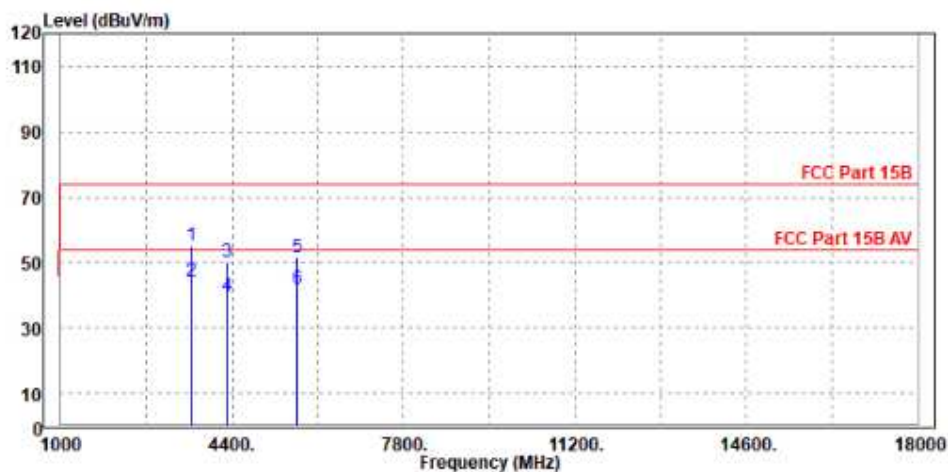
- REMARKS:**
1. Emission level(dBuV/m)=Read Value(dBuV) + Correction Factor(dB/m)
 2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) -Amplifier Gain
 3. The other emission levels were very low against the limit.
 4. Margin value = Emission level – Limit value.



TEST VOLTAGE	Data Transmission Input 120 Vac, 60 Hz	FREQUENCY RANGE	1-18 GHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70 %RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Peak/Average, 1 MHz
TESTED BY	Jace Hu		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
3601	55.24	56.86	74	-18.76	35.96	7.93	45.51	200	35	Peak
3601	44.29	45.91	54	-9.71	35.96	7.93	45.51	200	35	Average
4298	50.34	50.19	74	-23.66	36.22	9.34	45.41	200	50	Peak
4298	39.67	39.52	54	-14.33	36.22	9.34	45.41	200	50	Average
5692	51.57	49.41	74	-22.43	37.79	9.87	45.5	200	150	Peak
5692	41.79	39.63	54	-12.21	37.79	9.87	45.5	200	150	Average

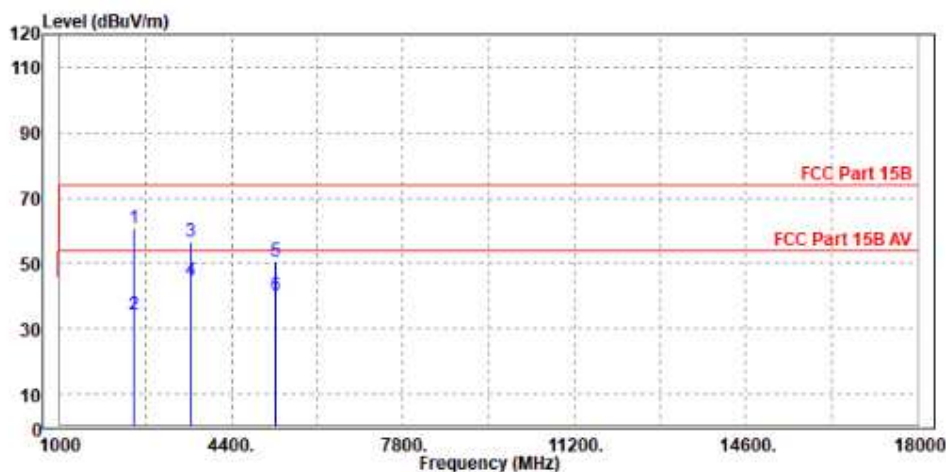
- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 1GHz to 5th harmonic of the highest frequency or 40GHz, whichever is lower .For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet.
 4. Only emissions significantly above equipment noise floor are reported.



TEST VOLTAGE	Data Transmission Input 120 Vac, 60 Hz	FREQUENCY RANGE	1-18 GHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70 %RH	DETECTOR FUNCTION & RESOLUTION BANDWIDTH	Peak/Average, 1 MHz
TESTED BY	Jace Hu		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	READ LEVEL (dBuV)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA FACTOR (dB /m)	CABLE LOSS (dB)	PREAMP FACTOR (dB)	ANTENNA HEIGHT (cm)	TABLE ANGLE (Degree)	REMARK
2462	60.61	67.25	74	-13.39	33.02	6.28	45.94	200	55	Peak
2462	34.26	40.9	54	-19.74	33.02	6.28	45.94	200	55	Average
3601	56.58	59.96	74	-17.42	34.2	7.93	45.51	200	84	Peak
3601	44.92	48.3	54	-9.08	34.2	7.93	45.51	200	84	Average
5267	50.84	51.16	74	-23.16	35.31	9.88	45.51	200	125	Peak
5267	39.97	40.29	54	-14.03	35.31	9.88	45.51	200	125	Average

- REMARKS:**
1. Peak detector quick scan is showed on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
 2. Negative sign (-) in the margin column signify levels below the limit.
 3. Frequency range scanned: 1GHz to 5th harmonic of the highest frequency or 40GHz, whichever is lower .For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet.
 4. Only emissions significantly above equipment noise floor are reported.



3 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications were made to the EUT by the lab during the test.

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